

508,748

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 October 2003 (02.10.2003)

PCT

(10) International Publication Number
WO 03/081691 A2

- (51) International Patent Classification⁷: **H01M**
- (21) International Application Number: PCT/EP03/02904
- (22) International Filing Date: 20 March 2003 (20.03.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
PG 2002 A 0015 22 March 2002 (22.03.2002) IT
- (71) Applicant (for all designated States except US): FUMA-TECH GMBH [DE/DE]; Am Grubenstollen 11, 66386 St. Ingbert/Saar (DE).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): ALBERTI, Giulio [IT/IT]; Via Torelli 67, I-06123 Perugia (IT). CASCIOLA,

Mario [IT/IT]; Via Cortonese 74/A, I-06123 Perugia (IT). PICA, Monica [IT/IT]; Fraz. Morano Madonnucchia 37/A, I-06123 Gualda Tadino (IT).

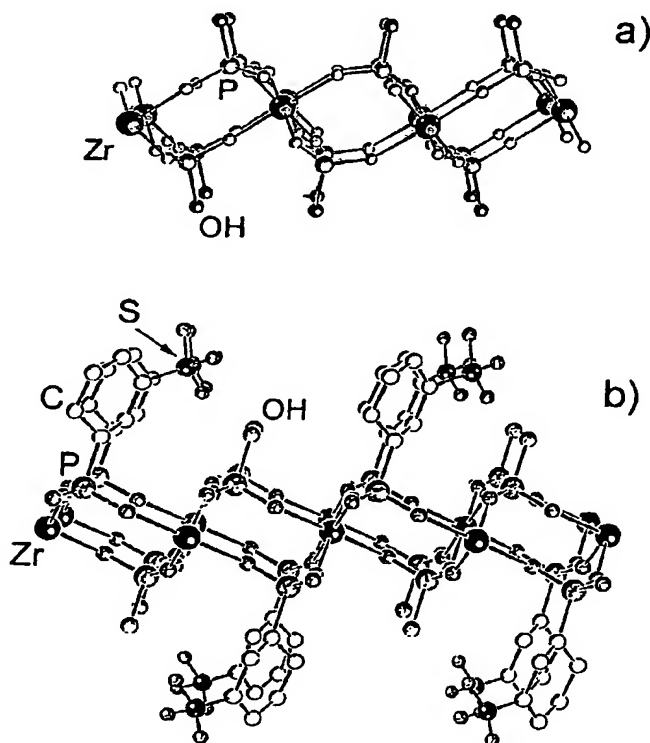
(74) Agent: RUFF, Michael; RUFF, WILHELM, BEIER, DAUSTER & PARTNER, Kronenstr. 30, 70174 Stuttgart (DE).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,

[Continued on next page]

(54) Title: AN INNOVATIVE METHOD FOR THE PREPARATION OF PROTON CONDUCTING NANOPOLYMERIC MEMBRANES FOR USE IN FUEL CELLS OR IN CATALYTIC MEMBRANE REACTORS



(57) Abstract: The invention is based on the preparation of an organic solution of preferably phosphonic acids and tetravalent metals salts, preferably of Zr, Ti, Sn and Ce, in organic solvents, which behaves as a solution of layered tetravalent metals salts, preferably phosphate-phosphonates, which are completely insoluble in the known solvents. This peculiarity allows an easy insertion of particles of the above compounds in the pores of porous membranes, in the matrices of those polymers, which are soluble in the same organic solvents, as well as in the membrane/electrode interfaces of fuel cells. The use of tetravalent metals salts, preferably zirconium phosphate-phosphonates, possessing high proton conductivity (in some cases higher than 10^{-1} S cm⁻¹) allows the preparation of impregnated porous membranes and of nano-polymeric membranes combining good mechanical properties, and/or reduced permeability to gaseous species, with good proton conductivity. These membranes can therefore be employed in fuel cells even at temperatures higher than 80 °C. These membranes also possess a high catalytic activity and can therefore be employed in catalytic membrane reactors.



WO 03/081691 A2